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☐ 1. Document ID: US 6289377 B1

L7: Entry 1 of 1

File: USPT

Sep 11, 2001

DOCUMENT-IDENTIFIER: US 6289377 B1

TITLE: Dynamic network configuration of a one-way adapter using a proxy agent that communicates with a resource server through a configured return path adapter

Abstract Text (1):

A one-way adapter such as a cable modem is initialized to allow a personal computer to receive data from a computer network such as the Internet via a broadcast channel, while transmitting data upstream to the computer network via a telephone line. First, a two-way adapter such as a phone modem is initialized by establishing a telephone link with a terminal server of an Internet Service Provider telephone network. The terminal server obtains an IP address from a phone network address server, and assigns the IP address to the phone modem stack. Next, the cable modem stack sends out a request for session initialization to a cable modem driver. The request is processed by a packet processing relay agent (PPRA), and the IP address of the phone modem is inserted into the packet. The IP packet destination address is set to that of a cable network address server. A cable network address server receives the packet via an upstream telephone line and responds with IP address and configuration information for the relay agent address. The phone modem receives the response and passes it to the cable modem stack via the PPRA. The cable modem is thus initialized with IP address and configuration information and is ready to receive Internet data via a one-way RF channel.

Brief Summary Text (36):

For ease of network operations and management, operators would like the one-way adapters to be configured dynamically with their IP address network configuration information.

Brief Summary Text (37):

The system should provide dynamic network configuration of a one-way adapter, such as a cable or satellite modem, that receives data from a computer network such as the Internet via a downstream broadcast channel of a cable or satellite television network, respectively. Such configuration provides IP addresses and configuration information for the duration of the Internet session. This address can be assigned to other modems when the user is not surfing.

Brief Summary Text (38):

Given that the adapter is one-way receive-only, and that the assignment of network configuration information requires a two-way send and receive communication link, the system should provide a proxy agent that facilitates the dynamic configuration of a one-way adapter and associated network services using a configured return path.

Brief Summary Text (49):

A phone link is established with an ISP terminal server to obtain an IP address and network configuration information that is required for the phone modem adapter's TCP/IP stack. On phone modems, the PPP is used for link establishment, and the IP address and network configuration information is obtained using IPCP, which is a subset of PPP.

Brief Summary Text (50):

Once the PPP link establishment phase is completed, the address and network configuration information is provided by a phone network address management server to the terminal server. The terminal server provides the information to the phone modem stack using IPCP. At this point, the phone modem and the corresponding stack is fully initialized and is capable of two-way communication with the Internet using the IP address obtained by the above PPP process as the source IP address.

Brief Summary Text (51):

The next step in the connection process is the initialization of the cable modem adapter. DHCP is one possible method of dynamically configuring network configuration information. From a network's perspective, the cable modem needs to send out a request for IP address and network configuration parameters. However, since the cable modem adapter is a one-way receive only adapter, the request cannot be sent out over an RF broadcast channel. This is why the PPRA is needed. The cable modem stack sends the request for initialization information to the PPRA via the cable modem driver.

Brief Summary Text (63):

The network address server responds to the packet communicated thereto by communicating address configuration information to two-way adapter via the second communication path according to the relay agent address. The packet processing relay agent obtains the address configuration information from the two-way adapter for use in initializing the one-way adapter.

Brief Summary Text (70):

The address configuration information may be provided by the network address server according to a DHCP.

Brief Summary Text (71):

The method may include the further step of providing a confirmation message from the one-way adapter to the network address server via the packet processing relay agent, two-way adapter, and second communication path to confirm receipt of the address configuration information at the one-way adapter.

Detailed Description Text (31):

At this point, two-way communication with servers on the Internet is possible over the phone link. Next, the cable modem stack needs to be initialized. This means that the cable modem needs to obtain its IP address and network configuration information. Since the cable modem 122 is a oneway, receive-only adapter, this request for information is sent out through the phone modem adapter 126 using the PPRA 124.

Detailed Description Text (58):

At block 825, the DHCP server, e.g., the cable network address server, responds to the packet with IP address configuration information for the relay agent address. That is, the destination address of the response is the IP address of the phone adapter.

Detailed Description Text (62):

At block 855, the PPRA process the packet for DHCP relay agent functions. At block 860, the PPRA sends the packet to the cable modem stack. At block 865, the cable modem receives the IP address and configuration information. At block 870, the cable modem sends out another DHCP request to the cable network address server

confirming that it received the information. The request is modified by the PPRA as per the original request (see blocks 810 and 815 in FIG. 8(a)).

Detailed Description Text (69):

The cable network address server responds to the packet with IP address and configuration information for the relay agent address. The phone modem receives the response from the cable modem address server and passes it to the cable modem stack via the PPRA to recover the IP address and configuration information. The cable modem is then initialized and ready to receive Internet data via a one-way RF channel.

CLAIMS:

1. A method for initializing a one-way adapter that receives data from a computer network via a first communication path, and communicates with a two-way adapter via a packet processing relay agent, wherein said two-way adapter is adapted to receive data from, and send data to, a service provider of said computer network via a second communication path, comprising the steps of:

establishing a link between said two-way adapter and said service provider via said second communication path;

obtaining an address from said service provider, and communicating said address to said packet processing relay agent via said second communication path and said two-way adapter;

providing a session initialization request packet from said one-way adapter to said packet processing relay agent;

said packet processing relay agent providing said session initialization request packet with: (a) a source address according to said address obtained from said service provider, and (b) a destination address of a network address server associated with said first communication path; and

communicating said session initialization request packet to said network address server via said two-way adapter and said second communication path according to said destination address thereof; wherein:

said network address server responds to said packet communicated thereto by communicating address configuration information to said two-way adapter via said second communication path; and

said packet processing relay agent obtains said address configuration information from said two-way adapter for use in providing initialization of said one-way adapter.

9. The method of claim 1, wherein:

said address configuration information is provided by said network address server according to a Dynamic Host Configuration Protocol.

10. The method of claim 1, comprising the further step of:

providing a confirmation message from said one-way adapter to said network address server via said packet processing relay agent, two-way adapter, and second communication path to confirm receipt of said address configuration information at said one-way adapter.

12. An apparatus for initializing a one-way adapter that receives data from a computer network via a first communication path, comprising:

a packet processing relay agent;

a two-way adapter that communicates with said one-way adapter via said packet processing relay agent;

said two-way adapter adapted to receive data from, and send data to, a service provider of said computer network via a second communication path;

means for establishing a link between said twoway adapter and said service provider via said second communication path;

means for obtaining an address from said service provider, and communicating said address to said packet processing relay agent via said second communication path and said two-way adapter; and

means for providing a session initialization request packet from said one-way adapter to said packet processing relay agent;

said packet processing relay agent providing said session initialization request packet with: (a) a source address according to said address obtained from said service provider, and (b) a destination address of a network address server associated with said first communication path; and

means for communicating said session initialization request packet to said network address server via said two-way adapter and said second communication path according to said destination address thereof; wherein:

said network address server responds to said packet communicated thereto by communicating address configuration information to said two-way adapter via said second communication path; and

said packet processing relay agent obtains said address configuration information from said two-way adapter for use in providing initialization of said one-way adapter.

20. The apparatus of claim 12, wherein:

said address configuration information is provided by said network address server according to a Dynamic Host Configuration Protocol.

21. The apparatus of claim 12, further comprising:

means for providing a confirmation message from said one-way adapter to said network address server via said packet processing relay agent, two-way adapter, and second communication path to confirm receipt of said address configuration information at said one-way adapter.

Full	Title	Citation	Front	Review	Classification	Date	Reference			Claims	KWIC	Draw. Data
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Term	Documents
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CONFIGURABIFITY	1
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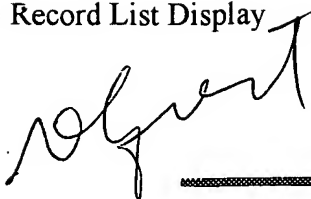
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Abstract Text (1):

A one-way adapter such as a cable modem is initialized to allow a personal computer to receive data from a computer network such as the Internet via a broadcast channel, while transmitting data upstream to the computer network via a telephone line. First, a two-way adapter such as a phone modem is initialized by establishing a telephone link with a terminal server of an Internet Service Provider telephone network. The terminal server obtains an IP address from a phone network address server, and assigns the IP address to the phone modem stack. Next, the cable modem stack sends out a request for session initialization to a cable modem driver. The request is processed by a packet processing relay agent (PPRA), and the IP address of the phone modem is inserted into the packet. The IP packet destination address is set to that of a cable network address server. A cable network address server receives the packet via an upstream telephone line and responds with IP address and configuration information for the relay agent address. The phone modem receives the response and passes it to the cable modem stack via the PPRA. The cable modem is thus initialized with IP address and configuration information and is ready to receive Internet data via a one-way RF channel.

Brief Summary Text (22):

RFC--Request For Comments;

Brief Summary Text (45):

Addresses, such as for a cable modem, are managed using the DHCP. DHCP, as specified in RFC 2131, is one of the commonly used protocols for network adapter configuration. Session initialization messages are UDP broadcasts sent out through the adapter that requires provisioning. Servers on the network listen to these broadcasts and send back the requested information. In a WAN environment, if the server is not on the same network as the client, a machine on the network functions as the DHCP proxy (relay agent) to communicate with the DHCP server. The relay agent receives the broadcasts from the client and sends them as unicast messages to the designated DHCP server(s). The server unicasts the responses to the relay agent, which in turn sends it to the client using the hardware address of the client.

Brief Summary Text (51):

The next step in the connection process is the initialization of the cable modem adapter. DHCP is one possible method of dynamically configuring network configuration information. From a network's perspective, the cable modem needs to send out a request for IP address and network configuration parameters. However,

since the cable modem adapter is a one-way receive only adapter, the request cannot be sent out over an RF broadcast channel. This is why the PPRA is needed. The cable modem stack sends the request for initialization information to the PPRA via the cable modem driver.

Brief Summary Text (52):

The PPRA handles the request and sends it out of the phone adapter via a telephone line to the cable network address management server (resource server) at the cable headend. The cable modem stack is a "client" that communicates with the cable network address management server using the Dynamic Host Configuration Protocol to request the initialization information.

Brief Summary Text (53):

One of the modifications performed by the PPRA is using the IP address obtained during PPP as the "DHCP relay agent" address. DHCP refers to a Dynamic Host Configuration Protocol. This information is embedded by the PPRA in the DHCP requests that the PPRA receives from the cable modem stack before forwarding the requests to the cable network address server via the phone modem adapter. The cable network address server/DHCP server then responds to the address of the relay agent (also known as a DHCP proxy agent). The PPRA identifies the packets as DHCP packets when they are received at the phone modem adapter and then forwards them to the cable modem stack. The cable modem stack is thereby initialized and able to receive Internet data via the one-way RF broadcast channel.

Brief Summary Text (56):

Generally, there is no point-to-point communication between the ISP phone network address server and the cable network address server. The request for session initialization for the cable modem adapter is a UDP/IP packet with the destination address of the cable network server, and is routed/forwarded through the phone network to the destination based on this address. The DHCP server/cable network address server responds to the DHCP relay agent address, which is the IP address associated with the phone modem.

Brief Summary Text (61):

The method includes the steps of: establishing a link between the two-way adapter and the service provider via the second communication path, e.g., in response to a user request to access the Internet, obtaining an address from the service provider, and communicating the address to the packet processing relay agent via the second communication path and the two-way adapter. A session initialization request packet is provided from the one-way adapter to the packet processing relay agent.

Brief Summary Text (62):

The packet processing relay agent provides the session initialization request packet with: (a) a source address according to the address obtained from the service provider, and (b) a destination address of a network address server (resource server) associated with the first communication path. The session initialization request packet is then communicated to the network address server via the two-way adapter and the second communication path according to the destination address thereof.

Brief Summary Text (64):

The link is established between the two-way adapter and the service provider via the second communication path in response to a user request to access the computer network.

Brief Summary Text (65):

The session initialization request packet is provided from the one-way adapter to the packet processing relay agent in response to a user request to access the computer network.

Detailed Description Text (27):

The data link layer 240 includes a phone modem driver 226, a PPRA 224, and a cable modem driver 222. The physical layer includes the phone modem 126 and cable modem 122. The PC receives data via the receive-only cable modem 122, and sends and receives data via the phone modem 126. For example, a user may enter a request at the user application layer 210 to view a web page at a web site on the Internet. In this case, processing flows from the user application layer 210, to the transport layer driver 220, to the network layer driver 230, to the cable modem driver, to the relay agent 224, to the phone modem driver 226, and finally to the phone modem 126. Note that the cable modem driver 222 sends the user request to the relay agent 224 instead of the cable modem 122. The phone modem 126 then uses the telephone link to forward a message to the phone network. The message is then routed to the appropriate Internet server based on its destination address.

Detailed Description Text (28):

The server 155 receives the request for the appropriate web page, typically according to the HTTP. The server 155 sends the requested information back to the PC 120 at the IP address associated with the cable modem adapter 122. Specifically, the requested information is sent to the MSO/cable operator's network, and is then sent over the RF channel 118 and received by the cable modem 222. Processing for this data flows from the cable modem 122, to the cable modem driver 222, to the network layer driver 230, to the transport layer driver 220, and finally to the user application layer 210, where it is processed by the browser and displayed on the PC's screen.

Detailed Description Text (30):

Firstly, the phone modem 126 needs to connect with the terminal server 144 and obtain an IP address that is then assigned to the TCP/IP stack associated with the phone modem. Information exchanged between the PC and the ISP phone network 140 during session initialization includes connection request and connection indication primitives.

Detailed Description Text (31):

At this point, two-way communication with servers on the Internet is possible over the phone link. Next, the cable modem stack needs to be initialized. This means that the cable modem needs to obtain its IP address and network configuration information. Since the cable modem 122 is a oneway, receive-only adapter, this request for information is sent out through the phone modem adapter 126 using the PPRA 124.

Detailed Description Text (32):

In response to the request, the IP address for the cable modem and network initialization information from the cable network address server 114 is received at the phone modem adapter 126 via the Internet 150 and the ISP phone network 140. Once the cable modem stack is initialized, all data communicated to the cable modem stack is received at the cable modem 122 and does not come through the phone modem 126.

Detailed Description Text (45):

The IP encapsulation header 510 includes an IP destination address for an IP decapsulator module 512, and an IP source address for the phone modem 514. The payload 550 carries another entire TCP packet 555, which includes an IP destination address for an Internet server 560 (or other location in a computer network), an IP source address for a cable modem stack 565, and a payload 570, such as data requesting to view a web page for the particular Internet server in the destination address 560. Here, the TCP packet 555 is tunneled within the TCP packet 500. This configuration circumvents the anti-spoofing filters used by telephone networks.

Detailed Description Text (48):

When the Internet server 155 of FIG. 1 receives a request to view a particular web page, the server transmits the web page as HTML data according to the IP source address for the cable modem stack 565 of FIG. 5. This IP source address 565 designates that the MSO router 116 should receive the requested web page or other data.

Detailed Description Text (49):

FIG. 6 illustrates a packet that is transmitted from a cable operator's network to a cable modem in accordance with the present invention. The web page or other Internet data is transmitted from the server 155 to the MSO router 116 as a TCP/IP packet 650, which includes the IP destination address for the cable modem stack 620, the IP source address of the Internet server 630, and a payload portion 640 comprising the requested web page data or other data.

Detailed Description Text (51):

FIG. 7 illustrates a process flow for initializing a two-way adapter such as a phone modem in accordance with the present invention. The initialization begins at block 700. At block 710, a user requests an Internet connection by clicking on a cable modem "connection software" icon, e.g., on the screen of the PC. The connection process includes two phases (e.g., initialization of the phone modem adapter, and of the cable modem adapter) and is controlled by a connection manager application of the PC.

Detailed Description Text (54):

FIG. 8(a) illustrates the first part of a process flow for initializing a one-way adapter such as a cable modem in accordance with the present invention. At block 800, the cable modem (CM) stack (e.g., stack 204 in FIG. 2) sends out a request for session initialization to the cable modem driver (e.g., driver 222 in FIG. 2). The request may be in the form of a DHCP/UDP/IP packet. At block 805, the PPRA (e.g., PPRA 224 in FIG. 2) receives the DHCP session initialization request from the CM driver.

Detailed Description Text (55):

At block 810, the PPRA may modify the DHCP session initialization request packet with "relay agent/proxy agent" functionality. Additionally, the IP address of the phone modem (see block 730 of FIG. 7) is inserted in the packet as the "relay agent" address. Furthermore, the IP packet destination address is set to that of the cable network address server (e.g., server 114 in FIG. 1), also known as the DHCP server address.

Detailed Description Text (62):

At block 855, the PPRA process the packet for DHCP relay agent functions. At block 860, the PPRA sends the packet to the cable modem stack. At block 865, the cable modem receives the IP address and configuration information. At block 870, the cable modem sends out another DHCP request to the cable network address server confirming that it received the information. The request is modified by the PPRA as per the original request (see blocks 810 and 815 in FIG. 8(a)).

Detailed Description Text (68):

Next, a one-way adapter such as a cable modem is initialized. The cable modem stack sends out a request for session initialization to a cable modem driver. The request is processed by a PPRA, and the IP address of the phone modem is inserted into the packet. The IP packet destination address is set to that of a cable network address server. The packet is sent out of the phone adapter and upstream to the cable network address server via the telephone line.

CLAIMS:

1. A method for initializing a one-way adapter that receives data from a computer network via a first communication path, and communicates with a two-way adapter via

a packet processing relay agent, wherein said two-way adapter is adapted to receive data from, and send data to, a service provider of said computer network via a second communication path, comprising the steps of:

establishing a link between said two-way adapter and said service provider via said second communication path;

obtaining an address from said service provider, and communicating said address to said packet processing relay agent via said second communication path and said two-way adapter;

providing a session initialization request packet from said one-way adapter to said packet processing relay agent;

said packet processing relay agent providing said session initialization request packet with: (a) a source address according to said address obtained from said service provider, and (b) a destination address of a network address server associated with said first communication path; and

communicating said session initialization request packet to said network address server via said two-way adapter and said second communication path according to said destination address thereof; wherein:

said network address server responds to said packet communicated thereto by communicating address configuration information to said two-way adapter via said second communication path; and

said packet processing relay agent obtains said address configuration information from said two-way adapter for use in providing initialization of said one-way adapter.

2. The method of claim 1, wherein:

said link is established between said two-way adapter and said service provider via said second communication path in response to a user request to access said computer network.

3. The method of claim 1, wherein:

said session initialization request packet is provided from said one-way adapter to said packet processing relay agent in response to a user request to access said computer network.

12. An apparatus for initializing a one-way adapter that receives data from a computer network via a first communication path, comprising:

a packet processing relay agent;

a two-way adapter that communicates with said one-way adapter via said packet processing relay agent;

said two-way adapter adapted to receive data from, and send data to, a service provider of said computer network via a second communication path;

means for establishing a link between said twoway adapter and said service provider via said second communication path;

means for obtaining an address from said service provider, and communicating said address to said packet processing relay agent via said second communication path and said two-way adapter; and

means for providing a session initialization request packet from said one-way adapter to said packet processing relay agent;

said packet processing relay agent providing said session initialization request packet with: (a) a source address according to said address obtained from said service provider, and (b) a destination address of a network address server associated with said first communication path; and

means for communicating said session initialization request packet to said network address server via said two-way adapter and said second communication path according to said destination address thereof; wherein:

said network address server responds to said packet communicated thereto by communicating address configuration information to said two-way adapter via said second communication path; and

said packet processing relay agent obtains said address configuration information from said two-way adapter for use in providing initialization of said one-way adapter.

13. The apparatus of claim 12, wherein:

said link is established between said two-way adapter and said service provider via said second communication path in response to a user request to access said computer network.

14. The apparatus of claim 12, wherein:

said session initialization request packet is provided from said one-way adapter to said packet processing relay agent in response to a user request to access said computer network.

Full	Title	Citation	Front	Review	Classification	Date	Reference			Claims	RMK	Draw De
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